

Review and Validation of Hourly VOC Data Collected by PAMS *AutoGC* Systems

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National Ambient Air Quality Standards (NAAQS) Rule

“Following the directives of the Clean Air Act (CAA), on October 1, 2015, Administrator McCarthy signed a rulemaking action that revises the current national ambient air quality standards (NAAQS) for ozone to a new, more protective level of 0.070 parts per million (70 parts per billion).”

-From EPA Memorandum re: Implementing the 2015 Ozone National Ambient Air Quality Standards, 1 Oct 2015

Changes to PAMS VOC monitoring requirements:

- ▶ Redistribution of sites - NCore sites in CBSA > 1 million
 - ▶ Additional monitors based on State EMPs for non-attainment areas
- ▶ Continuous Monitoring - canister samples only on waivers
- ▶ Hourly sampling only for ozone season

AUTOGE Systems

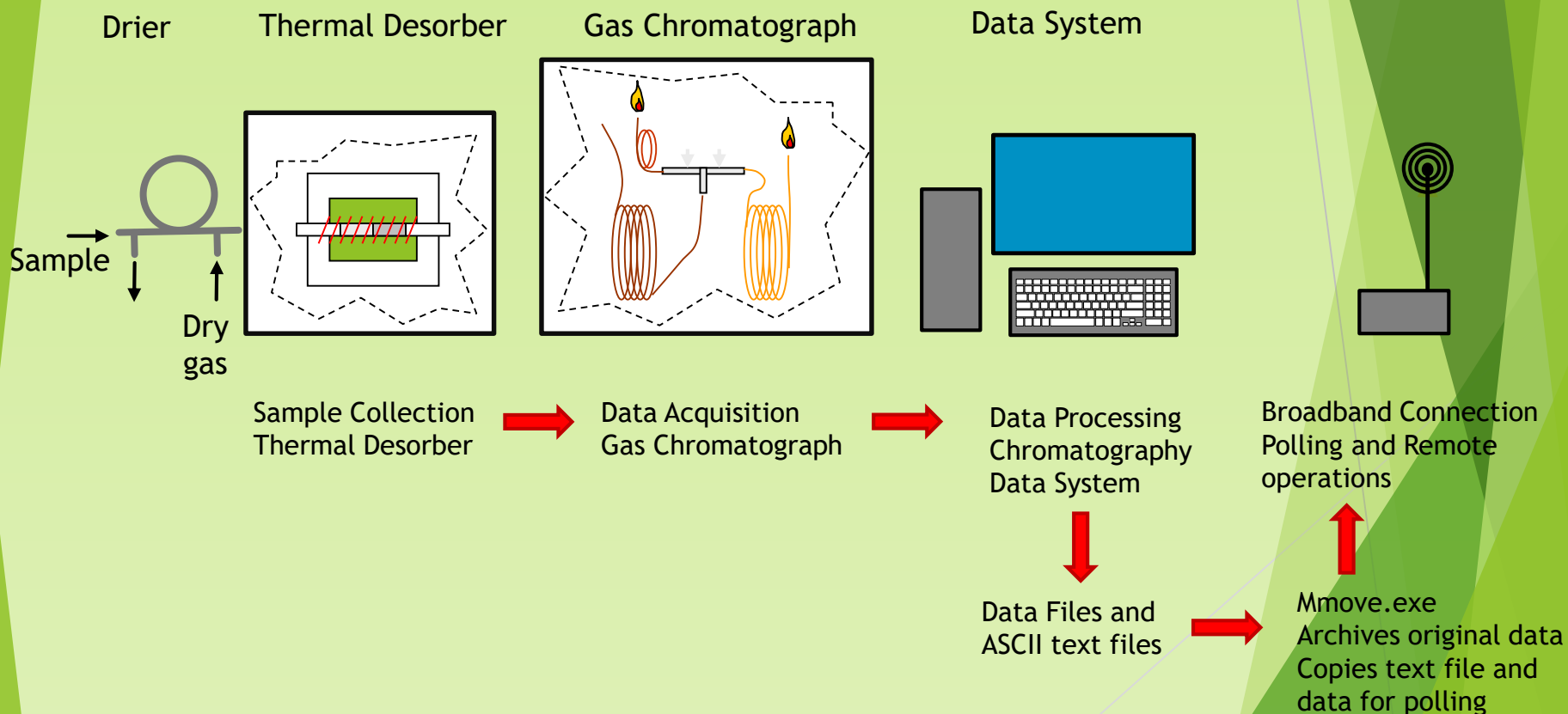
Continuous Monitoring June-August

- ▶ Key objectives of revised PAMS monitoring
 - ▶ Data to support the development of air quality models
 - ▶ Data to track continuing trends in air quality
- ▶ Data Collected will be archival in nature
 - ▶ Validation and review is a key element to the collection of data for use in future evaluations across sites and years.
 - ▶ Use of frequent quality checks to eliminate data losses.
 - ▶ Strong and unified quality assurance plan to insure data is uniform across sites.

AutoGC Systems: Data Management

Hourly Sample Collection and Separation

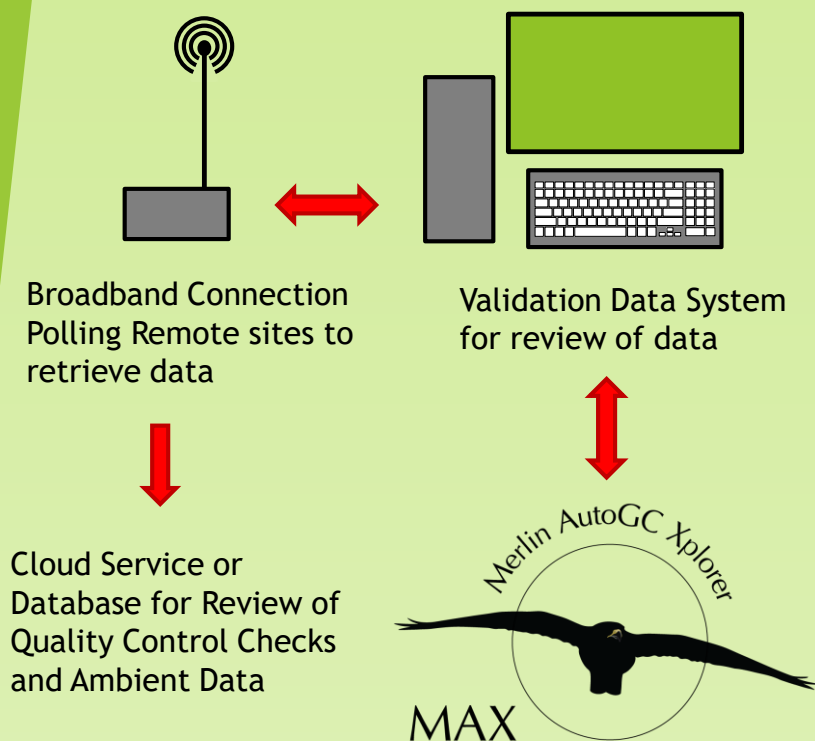
Laboratory Quality Analysis in the Field:
PerkinElmer and Agilent solutions configured by Orsat



AutoGC Systems: Data Management

Hourly Sample Collection and Separation

Data Validation Site: Review, validate and generate AQS Files



Data Loaded into Database for Review

Data Review QuickLooks
QC and control charts
Ambient Data

Chromatography Review
Review chromatographic data

Data Reprocessing, if
necessary, Reloaded and
Reviewed

Data Flagged and AIRS file
generation

AutoGC Systems: Data Management

Data Collection June to August

► Data Quality Objectives

- Bias 25%
- Precision 15-25%
- Detection Limit 0.5 ppbC
- Completeness 80% *

► Routine QC Data Collected

- Total hourly samples = 2208 (92 days)
- Daily Check Samples = 105
- Blanks = 92
- Retention time checks = 13
- Laboratory Check Samples = 13
- Ambient data = 1985/2208

- after adjustment for routine required quality control samples (10.1%).

AUTOGE Systems

- ▶ Key Issues Associated with Continuous Field Analysis
 - ▶ Hourly sample period consistent with other criteria measurements, NO_x, O₃
 - ▶ Power failures
 - ▶ Ambient temperatures
 - ▶ Accurate and repeatable target identification, retention time stability
 - ▶ Moisture related issues
 - ▶ Concentration related issues
 - ▶ Repeatable quantitation, changes in sensitivity, drift
 - ▶ System failures related to sampling times
 - ▶ Power failures
 - ▶ Sample pump failures

AUTOCE Systems

Automated Quality Control Checks

| Quality Control Check | Composition | Purpose | Frequency | Acceptance Criteria |
|---------------------------------------|--|--|-------------------------|---|
| Retention Time Standard (RTS) | Mixture containing all target compounds ideally between 1-5 ppbC | To help assess retention time shifts and optimize processing methods | Twice a month or weekly | 100% of the compounds are identified correctly in the multicomponent RTS |
| Calibration Verification Sample (CVS) | Mixture of 15 reference compounds including Propane and Benzene used for calibration | To assess the instrument drift and ensure continued instrument calibration | Daily | 1) Propane and Benzene % recoveries within 75% - 125% and all other calibrants within 55 - 145% |
| | | | | 2) Data must be bracketed by valid CVS |
| Method (Analytical) Blank | Humidified, clean air | To assess system contribution to the measurement | Daily | 1) All target compounds < 2.0 ppbC |
| | | | | 2) TNMHC < 20 ppbC |
| | | | | 3) Data must be bracketed by valid blanks |
| Precision Check | Mixture used for CVS | To assess analytical precision | Weekly | Propane and Benzene %RPD < 20% in two consecutive CVS runs |
| Laboratory Calibration Sample (LCS) | Mixture of 15 reference compounds including Propane and Benzene used for calibration | Second source standard, statically blended 5 ppbv | Twice a month or weekly | Propane and Benzene % recoveries within 70-130% |

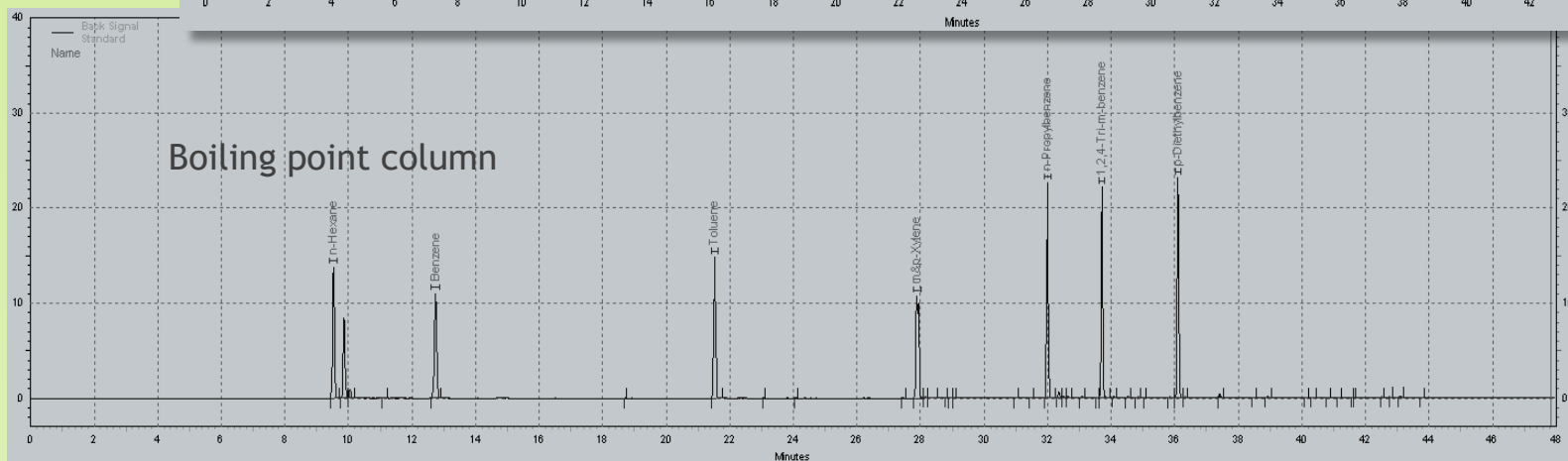
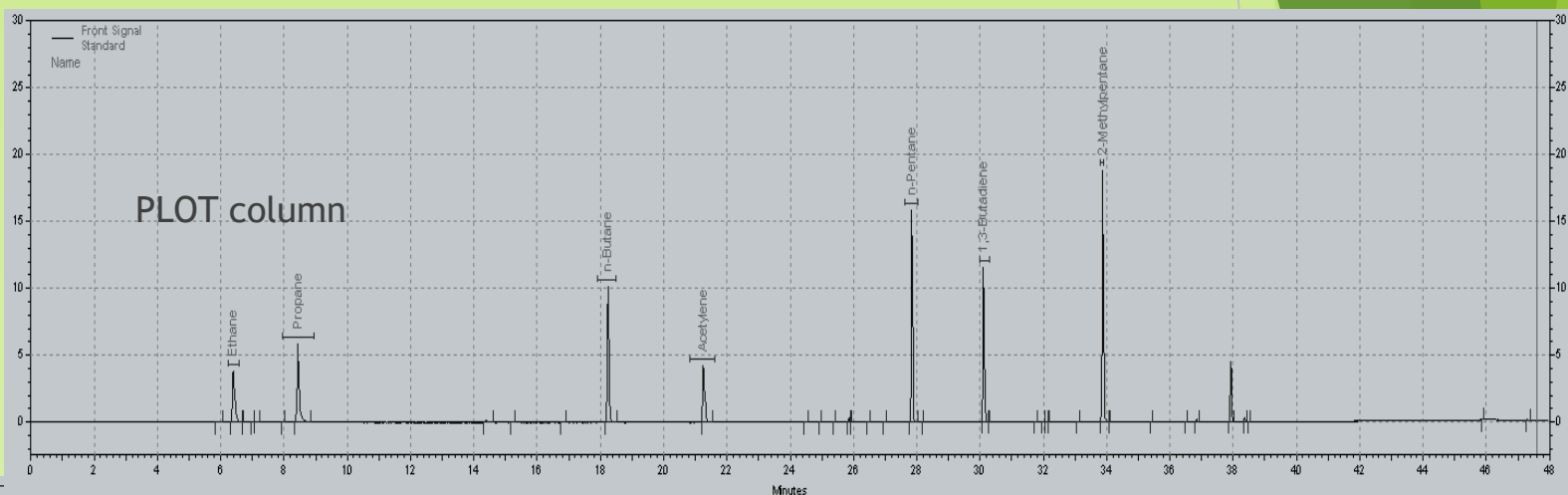
AutoGE Systems: Additional Automation for Introduction of Quality Control Samples

- ▶ Automatic introduction of QC samples
 - ▶ Dynamically diluted check sample
 - ▶ Analytical blank
- ▶ Manual dilution of multipoint calibration curve
- ▶ Dilution from 100 ppbv or 1 ppmv multi-component standard



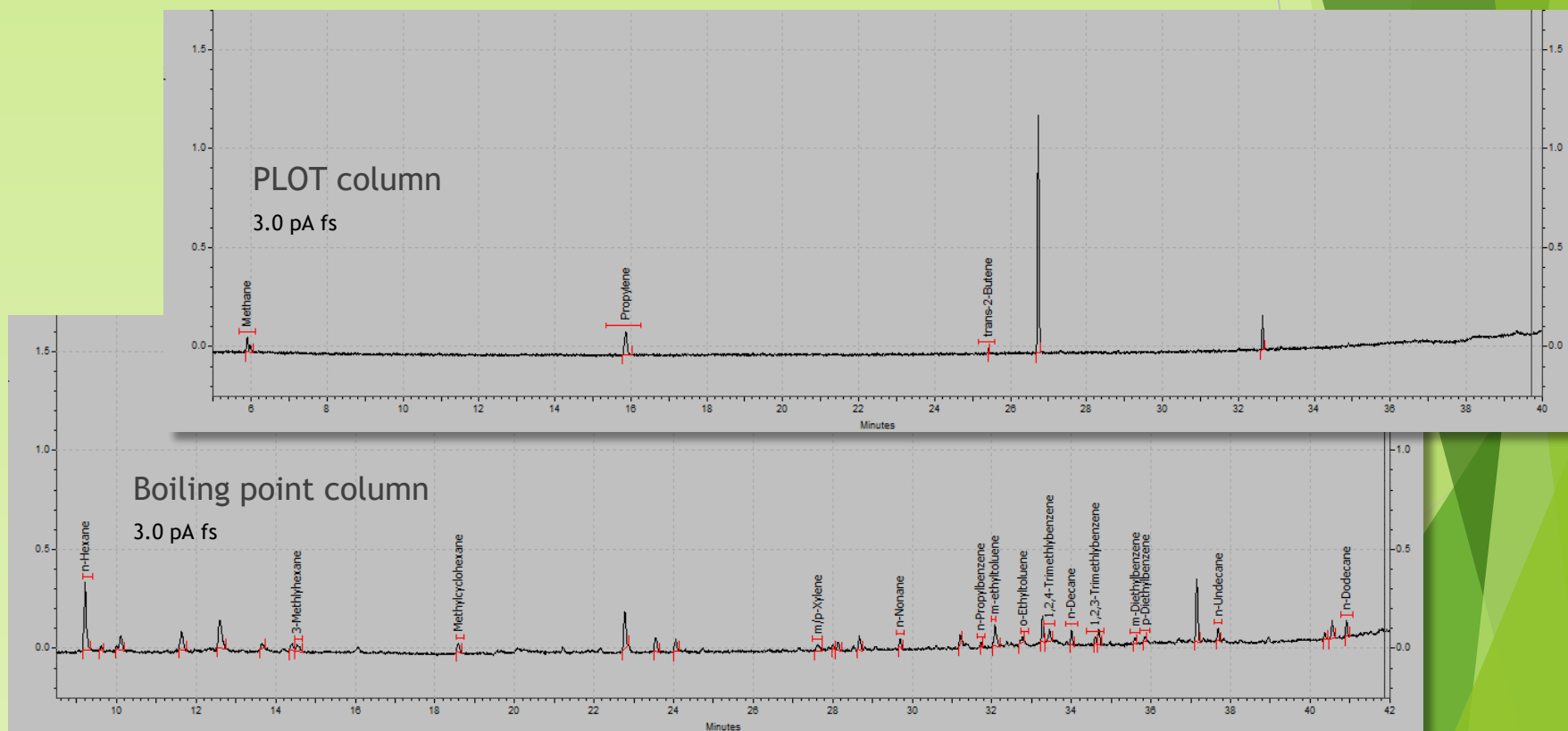
Daily Check Sample

Dynamic dilution from 1 ppmv to 5 ppbv

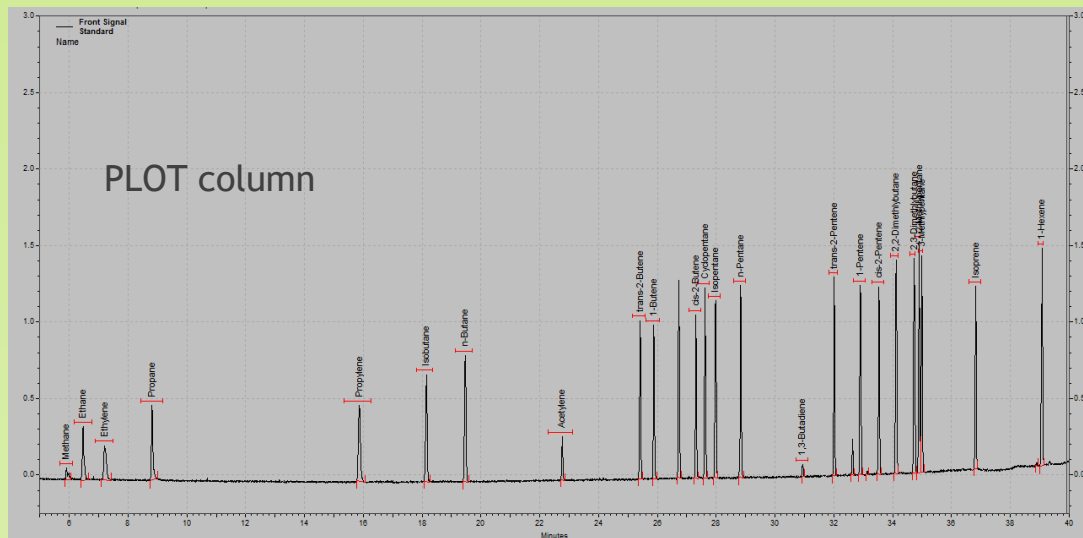


Analytical Blank

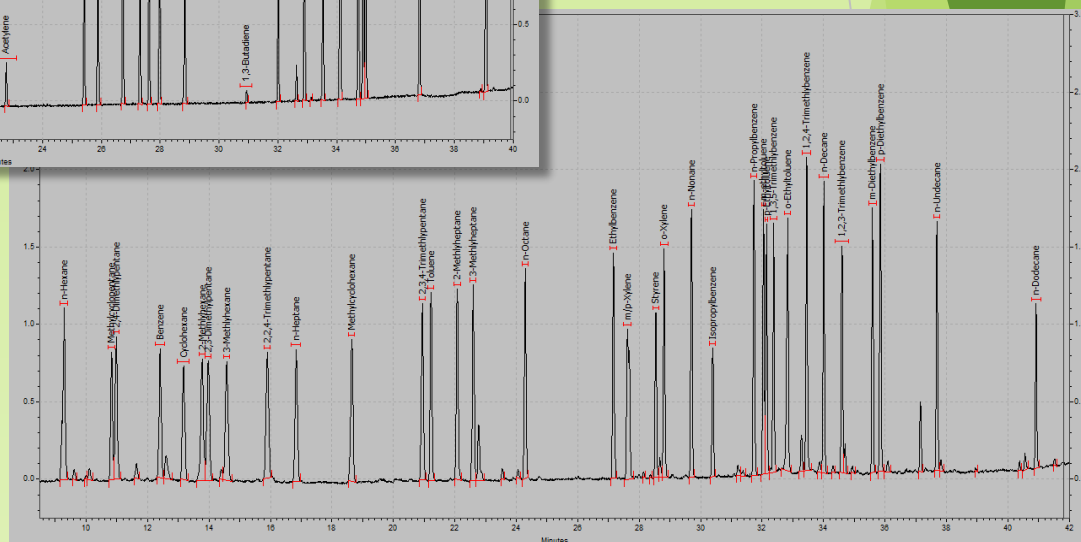
Dilution system zero diluent



Retention Time Standard “spike” in zero air



Boiling point column



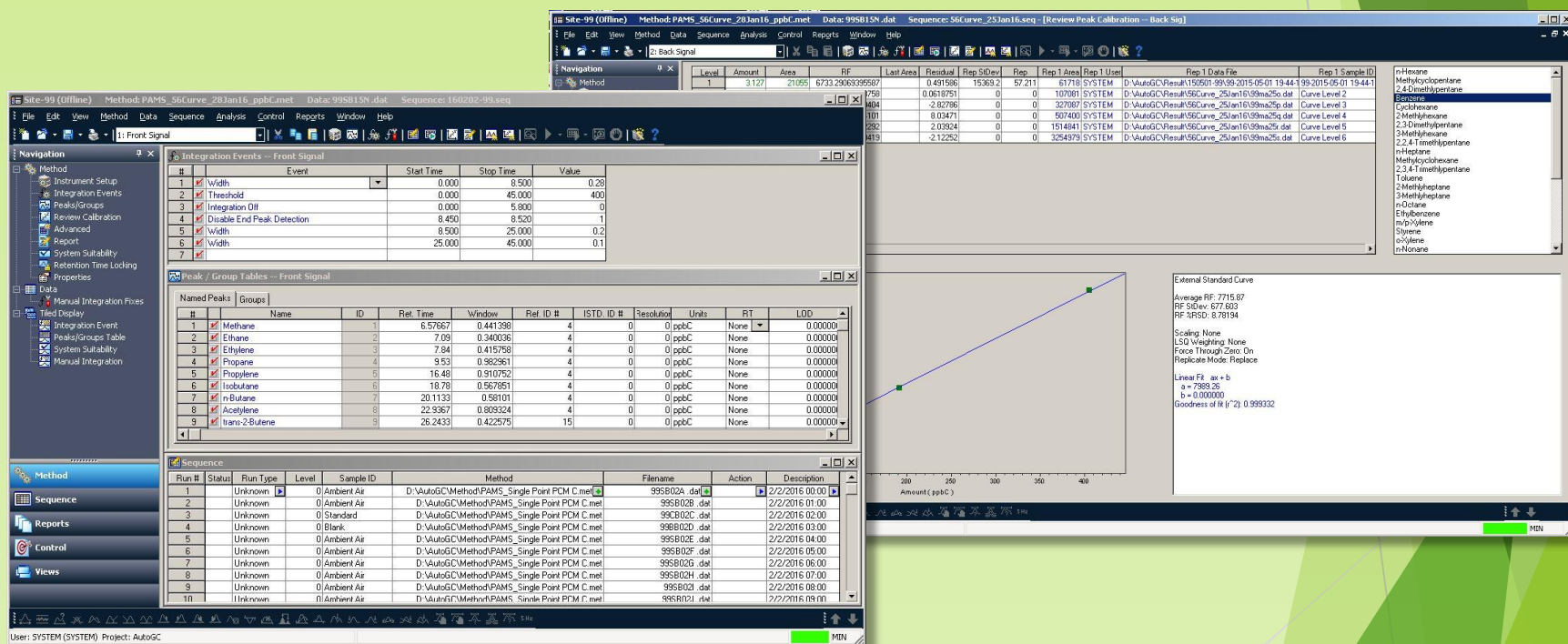
AutoGC Systems

Chromatography Data Systems

Requirements:

- ▶ Data portability
- ▶ Ability to reconstruct the original processing method from result
- ▶ Use of Retention time references to accommodate diurnal shifts
- ▶ Use of response factors and calibration by reference for unidentified HCs
- ▶ Ability to name files for easy identification of site, date, time, hour and sample type
- ▶ Ability to schedule and control introduction of routine quality control samples
- ▶ Ability to recover from simple power failures and continue hourly sampling

Method Development EZChrom Chromatography Data System



Method Development

TotalChrom Chromatography Data System

Components

Identification | Calibration | User Values/LIMS

Component Type
☒ Peak ☐ Named group ☐ Timed group

Name: N-HEXANE

Retention time: 10.206 min

Absolute window: 5.00 s

Relative window: 1.00 %

☒ Find tallest peak in window

☐ This component is a retention reference

Reference: BENZENE

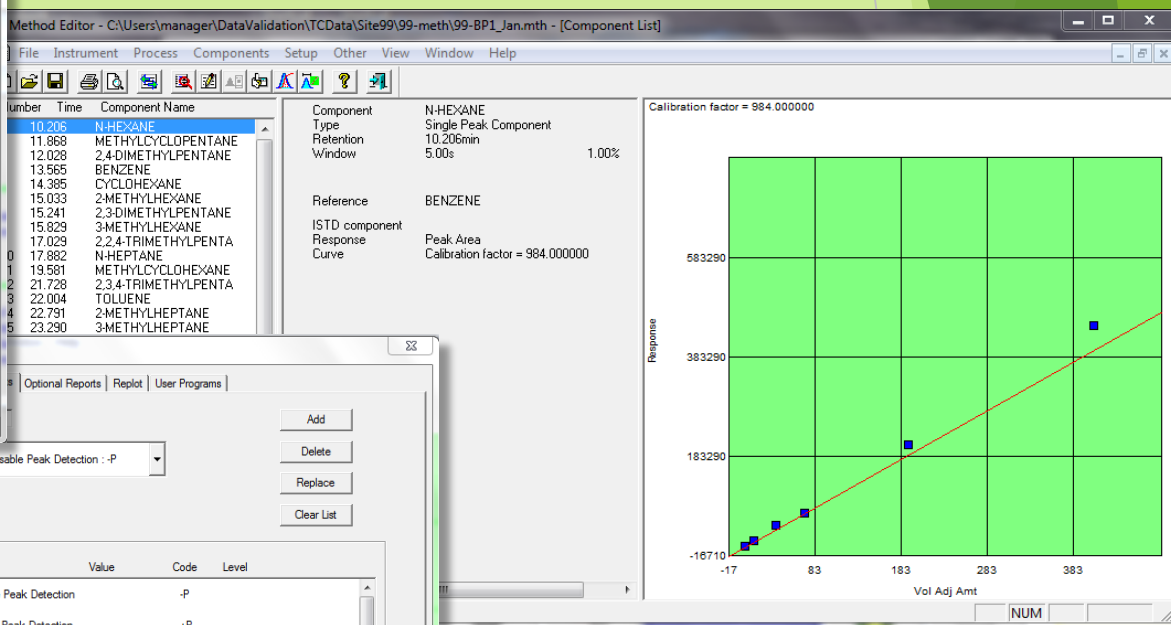
☐ This component is an internal standard

Internal Standard:

☐ Use this component as the RRT reference

Next Previous New Component Delete Component

Edit Component OK Cancel Apply



Optional Reports | Replot | User Programs

Add
Delete
Replace
Clear List

Event

Disable Peak Detection: -P

Defined Events

| Time | Event | Value | Code | Level |
|--------|------------------------|-------|------|-------|
| 0.058 | Disable Peak Detection | -P | | |
| 9.082 | Enable Peak Detection | +P | | |
| 28.028 | Set Bunching Factor | 4 | BF | |
| 28.356 | Set Bunching Factor | 2 | BF | |

☐ Correct actual times of all baseline events based on actual RT of nearest reference peak.

OK Cancel Apply

Time into run at which this event is to occur [0.000 to 160000.000]

AutoGC Systems

Meeting Data Quality Objectives

Operations

- ▶ Well defined Operating Procedures
- ▶ Well documented instrumental parameters
- ▶ Fully automated system to reduce errors in operator activities
- ▶ Easily identifiable and transportable data files
- ▶ Fully automated Quality Checks

Data Validation

- ▶ Well defined Quality Control Limits
- ▶ Real-time data transfer and review
- ▶ Well defined validation operating procedures
- ▶ Good annual audits to review instrument performance across network.

AutoGC Systems

Data Review - Data Validation

Data Review - Daily

- ▶ Site Operations
 - ▶ On-time collection
 - ▶ Correct identification
 - ▶ Equipment parameters
- ▶ Quality Controls
 - ▶ Passing Blanks
 - ▶ Passing check sample recovery

Data Validation - Monthly

- ▶ Review of Quality Controls
 - ▶ Passing check sample recoveries - flagging
 - ▶ Passing blanks - flagging failed targets
 - ▶ Retention time checks
- ▶ Review of Ambient Data
 - ▶ Review of high hours or other issues
 - ▶ Review data for internal consistency

AutoGC Systems

Validation Levels

PAMS Data Analysis Workbook: Data Validation

Level 0 - Routine Data Checks

- ▶ Sampling errors
- ▶ Instrumental failures

Level 1 - Evaluation of Quality Control Data

- ▶ Pass/Fail criteria for daily checks
- ▶ Review of target identification
 - ▶ Use time series plots to evaluate outliers
 - ▶ Use retention time plots to determine misidentifications

Level II - Temporal and Spatial Consistency

- ▶ Abundant species present
- ▶ Diurnal patterns
- ▶ Statistical evaluation of historical data

Level III - External Verifications

- ▶ Second source static dilution
- ▶ Co-located collection results
- ▶ Performance Audits

AUTOGC Systems: Level 0 Data Review



Verify sampling
Lost Data

Choose year and month to generate ... 2017-03 Go

Daily Recovery: Monthly Recovery: Total Tx: 1242 / 1488 Recovery: 83.47%

| Date | Hours | View |
|-----------------|------------|--|
| Wed Mar 01 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Thu Mar 02 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Fri Mar 03 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Sat Mar 04 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Sun Mar 05 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Mon Mar 06 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Tue Mar 07 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Wed Mar 08 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Thu Mar 09 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Fri Mar 10 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Sat Mar 11 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Sun Mar 12 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Mon Mar 13 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Tue Mar 14 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Wed Mar 15 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Thu Mar 16 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Fri Mar 17 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Sat Mar 18 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Sun Mar 19 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Mon Mar 20 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Tue Mar 21 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Wed Mar 22 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Thu Mar 23 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Fri Mar 24 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Sat Mar 25 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Sun Mar 26 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Mon Mar 27 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Tue Mar 28 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Wed Mar 29 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Thu Mar 30 2017 | A B [Grid] | Amount Area Retention Time Response Factor |
| Fri Mar 31 2017 | A B [Grid] | Amount Area Retention Time Response Factor |

AUTOGC Systems: Level 0 Data Review



Verify sampling - incorrect sampling interval

MAX Daily QuickLook

Standard Summary

Filename: 99SD06H.DAT
Data Acquisition Time: 2017-04-06 07:45:12
Process Date: 2017-05-13 22:40:24

Valid: Passed

| LABELS | FORMULA | VALUE | RESULT |
|---|--|----------------------|----------|
| Data Acquisition Time | A _T | 07:45:12 | 07:45:12 |
| Sample Time - Start S _{T1} | A _T - 00:40 | 07:45:12 - 00:40 | 07:05:12 |
| Sample Time - End S _{T2} | A _T | 07:45:12 | 07:45:12 |
| Sample Hour S _H | A _T - 00:20(truncate to hour) | 07:45:12 - 00:20 | 07:00 |
| Valid Sample Hour Limit 1 S _{L1} | S _H - 00:10 | 07:00 - 00:10 | 06:50:00 |
| Valid Sample Hour Limit 2 S _{L2} | S _H + 01:10 | 07:00 + 01:10 | 08:10:00 |
| Validity Test 1 | S _{T1} >= S _{L1} | 07:05:12 >= 06:50:00 | Passed |
| Validity Test 2 | S _{T1} <= S _{L2} | 07:45:12 <= 08:10:00 | Passed |

Reprocessed: True

Reupload: True

Mismatch: False

Close

| HR | STATUS | CHART | FILE | TIME | RETNAME | ETNAME |
|-------|--------|-------|---------|-------|---------|---------|
| 00:00 | III | ✓ | 99SD06A | 00:45 | 45.4202 | 33.212 |
| 01:00 | III | ✓ | 99SD06B | 01:45 | 28.2573 | 37.2283 |
| 02:00 | III | ✓ | 99SD06C | 02:45 | 0.1998 | 10.611 |
| 03:00 | III | ✓ | 99SD06D | 03:45 | 0.1709 | |
| 04:00 | III | ✓ | 99SD06E | 04:45 | 20.5554 | 40.0161 |
| 05:00 | III | ✓ | 99SD06F | 05:45 | 27.3628 | 19.782 |
| 06:00 | III | ✓ | 99SD06G | 06:45 | 30.9140 | 25.0372 |
| 07:00 | III | ✓ | 99SD06H | 07:45 | 30.5257 | 20.5015 |
| 08:00 | I | ✗ | 99SD06I | 08:00 | LST | LST |
| 09:00 | III | ✓ | 99SD06J | 09:45 | 23.0789 | 13.8289 |
| 10:00 | III | ✓ | 99SD06K | 10:45 | 22.5913 | 6.5076 |
| 11:00 | III | ✓ | 99SD06L | 11:45 | 22.082 | 5.3580 |
| 12:00 | III | ✓ | 99SD06M | 12:45 | 22.2973 | 5.1175 |
| 13:00 | III | ✓ | 99SD06N | 13:45 | 22.2440 | 5.4812 |
| 14:00 | III | ✓ | 99SD06O | 14:45 | 22.7931 | 5.6108 |
| 15:00 | III | ✓ | 99SD06P | 15:45 | 22.7272 | 5.4123 |
| 16:00 | III | ✓ | 99SD06Q | 16:45 | 22.4778 | 5.6733 |
| 17:00 | III | ✓ | 99SD06R | 17:45 | 22.2411 | 6.0106 |
| 18:00 | III | ✓ | 99SD06S | 18:45 | 22.0659 | 8.4454 |
| 19:00 | III | ✓ | 99SD06T | 19:45 | 23.5743 | 10.414 |
| 20:00 | III | ✓ | 99SD06U | 20:45 | 25.2085 | 21.4398 |
| 21:00 | III | ✓ | 99SD06V | 21:45 | 22.4815 | 11.8745 |
| 22:00 | III | ✓ | 99SD06W | 22:45 | 22.1801 | 9.7329 |
| 23:00 | III | ✓ | 99SD06X | 23:45 | 23.5887 | 8.0363 |

| 2-ETHYL-2-THIOUREA | 2-METHYL-2-THIOUREA | 2-PYRIDONE | OS-4-PYRIDONE | 2,2-DIMETHYL-2-THIOUREA | 2,3-DIMETHYL-2-THIOUREA | 2-AMINO-2-THIOUREA | 2-AMINO-2-THIOUREA | ISOBUTENE | 1-PYRIDONE | TOTAL 1-PYRIDONE | TOTAL 2-PYRIDONE | TIME | FILE NAME | CHART |
|--------------------|---------------------|------------|---------------|-------------------------|-------------------------|--------------------|--------------------|-----------|------------|------------------|------------------|---------|-----------|-------|
| 2.2321 | 1.3957 | 0.9703 | 2.547 | 5.2052 | 23.0077 | 13.1937 | 0.304 | 0.2052 | 453.0010 | 458.021 | 00:45 | 99SD06A | ✓ | |
| 1.8905 | 1.9696 | 0.8054 | 1.6002 | 3.6209 | 12.9349 | 7.8025 | 0.5291 | 0.2286 | 309.7701 | 313.220 | 01:45 | 99SD06B | ✓ | |
| 0.1612 | | 0.0459 | | 31.4499 | | | | | 137.2951 | 144.751 | 02:45 | 99SD06C | ✓ | |
| 0.0940 | | 0.0335 | | | | | | | 0.9399 | 0.94 | 03:45 | 99SD06D | ✓ | |
| 3.1994 | 1.8439 | 1.0649 | 1.242 | 3.1298 | 9.8186 | 5.9508 | 0.0944 | 0.2996 | 244.2398 | 251.285 | 04:45 | 99SD06E | ✓ | |
| 6.8315 | 1.4502 | 1.7304 | 2.4081 | 5.3798 | 22.9867 | 13.353 | 0.3542 | 0.3829 | 419.2692 | 425.385 | 05:45 | 99SD06F | ✓ | |
| 7.9911 | 1.7213 | 1.9587 | 3.0423 | 7.5710 | 35.1605 | 20.0953 | 0.0205 | 0.4723 | 580.1888 | 587.845 | 06:45 | 99SD06G | ✓ | |
| 5.3869 | 1.4002 | 1.9658 | 3.0105 | 7.7704 | 22.5905 | 13.5147 | 0.3347 | 0.3224 | 484.4183 | 489.566 | 07:45 | 99SD06H | ✓ | |
| LST | LST | LST | LST | LST | LST | LST | LST | LST | 0 | 0 | 08:00 | 99SD06I | ✗ | |
| 0.6606 | 0.1785 | 0.1771 | 0.3771 | 0.9829 | 2.956 | 1.8438 | 0.6049 | 0.557 | 113.2053 | 114.728 | 09:45 | 99SD06J | ✓ | |
| 0.4723 | 0.1013 | 0.0956 | 0.2385 | 0.4939 | 1.3717 | 0.7856 | 0.2342 | 0.2679 | 63.7807 | 65.2659 | 10:45 | 99SD06K | ✓ | |
| 0.418 | 0.1261 | 0.0718 | 0.2725 | 0.5842 | 1.7305 | 1.0101 | 0.1284 | 0.0949 | 64.5732 | 65.5191 | 11:45 | 99SD06L | ✓ | |
| 0.2727 | 0.0692 | 0.0387 | 0.2218 | 0.4362 | 1.2358 | 0.7147 | 0.0994 | 0.0243 | 55.536 | 56.2835 | 12:45 | 99SD06M | ✓ | |
| 0.286 | 0.1361 | 0.0578 | 0.2241 | 0.5229 | 1.4917 | 0.8809 | 0.1869 | 0.0566 | 59.8127 | 60.7649 | 13:45 | 99SD06N | ✓ | |
| 0.3156 | 0.1307 | 0.0413 | 0.3028 | 0.5606 | 1.8321 | 1.0281 | 0.1009 | | 67.3887 | 68.3991 | 14:45 | 99SD06O | ✓ | |
| 0.5717 | 0.2043 | 0.1253 | 0.4031 | 0.8694 | 2.6704 | 1.5566 | 0.1084 | 0.0471 | 82.5363 | 83.0655 | 15:45 | 99SD06P | ✓ | |
| 0.4708 | 0.1642 | 0.0997 | 0.3443 | 0.6912 | 2.0242 | 1.1748 | 0.154 | 0.0127 | 73.6889 | 74.8031 | 16:45 | 99SD06Q | ✓ | |
| 0.2577 | 0.105 | 0.0452 | 0.2612 | 0.5763 | 1.6753 | 0.9498 | 0.2399 | 0.0818 | 68.8009 | 69.7529 | 17:45 | 99SD06R | ✓ | |
| 0.5595 | 0.2 | 0.1814 | 0.4759 | 1.0634 | 3.6985 | 2.1412 | 0.62 | 0.1858 | 96.8981 | 98.3309 | 18:45 | 99SD06S | ✓ | |
| 1.7863 | 0.6815 | 0.7923 | 1.5724 | 3.3240 | 11.4989 | 6.7893 | 0.6437 | 0.3003 | 228.4002 | 231.10 | 19:45 | 99SD06T | ✓ | |
| 0.8107 | 0.3741 | 0.2988 | 0.6773 | 1.49 | 4.634 | 2.9323 | 0.946 | 0.2219 | 144.7190 | 150.936 | 20:45 | 99SD06U | ✓ | |
| 0.3324 | 0.1825 | 0.1113 | 0.3329 | 0.794 | 2.1892 | 1.4135 | 0.2572 | 0.0749 | 76.9498 | 80.517 | 21:45 | 99SD06V | ✓ | |
| 0.2577 | 0.105 | 0.0452 | 0.2612 | 0.5763 | 1.6753 | 0.9498 | 0.2399 | 0.0818 | 68.8009 | 69.7529 | 17:45 | 99SD06R | ✓ | |
| 0.5595 | 0.2 | 0.1814 | 0.4759 | 1.0634 | 3.6985 | 2.1412 | 0.62 | 0.1858 | 96.8981 | 98.3309 | 18:45 | 99SD06S | ✓ | |
| 1.7863 | 0.6815 | 0.7923 | 1.5724 | 3.3240 | 11.4989 | 6.7893 | 0.6437 | 0.3003 | 228.4002 | 231.10 | 19:45 | 99SD06T | ✓ | |
| 0.8107 | 0.3741 | 0.2988 | 0.6773 | 1.49 | 4.634 | 2.9323 | 0.946 | 0.2219 | 144.7190 | 150.936 | 20:45 | 99SD06U | ✓ | |
| 0.3324 | 0.1825 | 0.1113 | 0.3329 | 0.794 | 2.1892 | 1.4135 | 0.2572 | 0.0749 | 76.9498 | 80.517 | 21:45 | 99SD06V | ✓ | |
| 0.2577 | 0.105 | 0.0452 | 0.2612 | 0.5763 | 1.6753 | 0.9498 | 0.2399 | 0.0818 | 68.8009 | 69.7529 | 17:45 | 99SD06R | ✓ | |
| 0.5595 | 0.2 | 0.1814 | 0.4759 | 1.0634 | 3.6985 | 2.1412 | 0.62 | 0.1858 | 96.8981 | 98.3309 | 18:45 | 99SD06S | ✓ | |

AUTOGC Systems: Level I Data Review



QuickLook Daily Check Sample

QuickLook Weekly Static 2nd Source Check Sample

Channel A: CVS Concentration (2017-05-20)

Cylinder: CC344433 Date On: 2017-02-21 00:00:00 Date Off: 2017-06-02 15:59:59 Dilution Factor: 0.00483
[Propane RF = 13195]

| NAME | CARBON NUMBER | CERT CONC (PPMV) | CALC DILUTED CONC (PPBC) | MEASURED CONC 1 (PPBC) | RUN 1 % RECOVERY (99CE20C.DAT) | RECOVERY MIN/MAX |
|-----------------|---------------|------------------|--------------------------|------------------------|--------------------------------|------------------|
| ETHANE | 2 | 109 | 10.53 | 11.34 | 107.66 | 55/145 |
| PROPANE | 3 | 104 | 15.07 | 15.70 | 104.21 | 75/125 |
| N-BUTANE | 4 | 109 | 21.06 | 21.99 | 104.44 | 55/145 |
| ACETYLENE | 2 | 109 | 10.53 | 7.05 | 66.92 | 55/145 |
| N-PENTANE | 5 | 107 | 25.84 | 26.90 | 104.11 | 55/145 |
| 1,3-BUTADIENE | 4 | 106 | 20.48 | 21.05 | 102.78 | 55/145 |
| 2-METHYLPENTANE | 6 | 104 | 30.14 | 32.24 | 106.96 | 55/145 |

Blank Run: (99BE20D.DAT) 0.4572

Channel B: CVS Concentration (2017-05-20)

Cylinder: CC344433 Date On: 2017-02-21 00:00:00 Date Off: 2017-06-02 15:59:59 Dilution Factor: 0.00483
[Benzene RF = 12828]

| NAME | CARBON NUMBER | CERT CONC (PPMV) | CALC DILUTED CONC (PPBC) | MEASURED CONC 1 (PPBC) | RUN 1 % RECOVERY (99CE20C.DAT) | RECOVERY MIN/MAX |
|---------------------|---------------|------------------|--------------------------|------------------------|--------------------------------|------------------|
| N-HEXANE | 6 | 108 | 31.30 | 33.02 | 105.5 | 55/145 |
| BENZENE | 6 | 110 | 31.88 | 32.54 | 102.07 | 75/125 |
| TOLUENE | 7 | 110 | 37.19 | 37.61 | 101.11 | 55/145 |
| M&P-XYLENE | 8 | 110 | 42.50 | 42.44 | 99.85 | 55/145 |
| N-PROPYLBENZENE | 9 | 103 | 44.77 | 46.62 | 104.12 | 55/145 |
| 1,2,4-TRI-M-BENZENE | 9 | 107 | 46.51 | 45.70 | 98.26 | 55/145 |
| P-DIETHYLBENZENE | 10 | 100 | 48.30 | 47.11 | 97.54 | 55/145 |

Blank Run: (99BE20D.DAT) 9.1965

Channel A: LCS Concentration (2017-05-20)

Cylinder: AAL7395 Date On: 2016-01-01 00:00:00 Date Off: In Use Dilution Factor: 0.00548
[Propane RF = 13195]

| NAME | CARBON NUMBER | CERT CONC (PPMV) | CALC DILUTED CONC (PPBC) | MEASURED CONC 1 (PPBC) | RUN 1 % RECOVERY (99EE20V.DAT) | RECOVERY MIN/MAX |
|-----------------|---------------|------------------|--------------------------|------------------------|--------------------------------|------------------|
| ETHANE | 2 | 106 | 11.62 | 9.20 | 79.22 | 70/130 |
| PROPANE | 3 | 0.99 | 16.28 | 13.63 | 83.77 | 70/130 |
| N-BUTANE | 4 | 0.98 | 21.48 | 17.46 | 81.3 | 70/130 |
| ACETYLENE | 2 | 0.99 | 10.85 | 9.19 | 84.67 | 70/130 |
| N-PENTANE | 5 | 1.04 | 28.50 | 22.61 | 79.34 | 70/130 |
| 1,3-BUTADIENE | 4 | 0.92 | 20.17 | 17.15 | 85.03 | 70/130 |
| 2-METHYLPENTANE | 6 | 0.96 | 31.56 | 27.84 | 88.2 | 70/130 |

Blank Run: (99BE20D.DAT) 0.4572

Channel B: LCS Concentration (2017-05-20)

Cylinder: AAL7395 Date On: 2016-01-01 00:00:00 Date Off: In Use Dilution Factor: 0.00548
[Benzene RF = 12828]

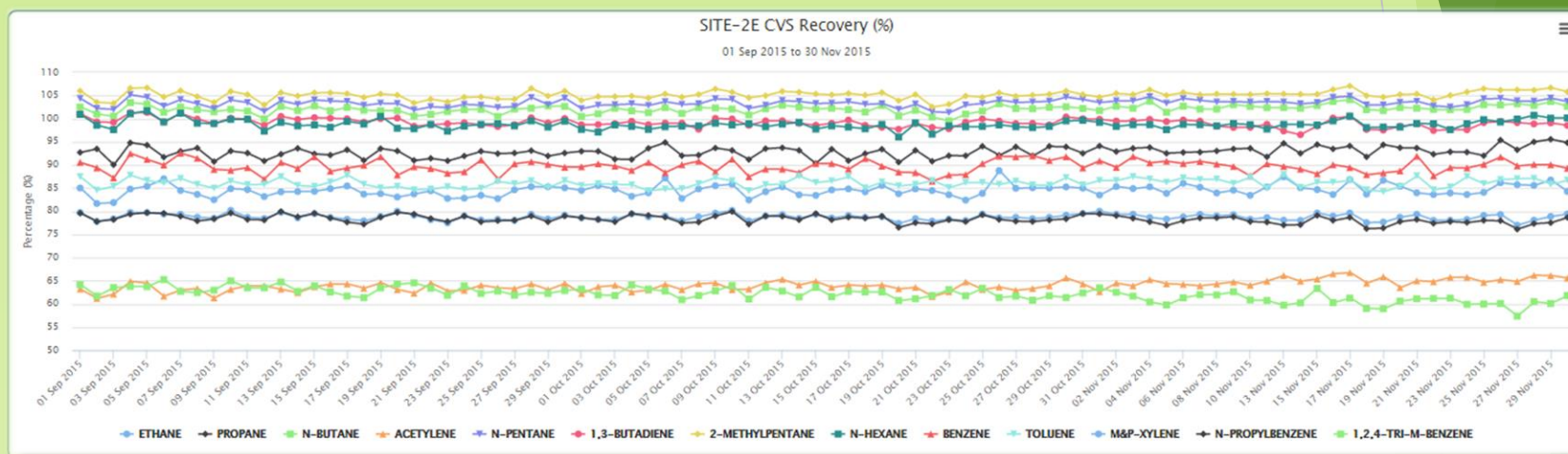
| NAME | CARBON NUMBER | CERT CONC (PPMV) | CALC DILUTED CONC (PPBC) | MEASURED CONC 1 (PPBC) | RUN 1 % RECOVERY (99EE20V.DAT) | RECOVERY MIN/MAX |
|---------------------|---------------|------------------|--------------------------|------------------------|--------------------------------|------------------|
| N-HEXANE | 6 | 1.00 | 32.88 | 27.92 | 84.93 | 70/130 |
| BENZENE | 6 | 1.05 | 34.52 | 27.69 | 80.22 | 70/130 |
| TOLUENE | 7 | 1.05 | 40.28 | 32.44 | 80.54 | 70/130 |
| M&P-XYLENE | 8 | 0.97 | 42.52 | 37.53 | 88.26 | 70/130 |
| N-PROPYLBENZENE | 9 | 1.02 | 50.31 | 42.49 | 84.46 | 70/130 |
| 1,2,4-TRI-M-BENZENE | 9 | 0.95 | 46.85 | 41.23 | 87.99 | 70/130 |
| P-DIETHYLBENZENE | 10 | 0.95 | 52.06 | 44.74 | 85.94 | 70/130 |

Blank Run: (99BE20D.DAT) 9.1965

AUTOGC Systems: Level I Data Review

Calibration Verification Sample (CVS)

Dynamically Diluted Daily Check Sample

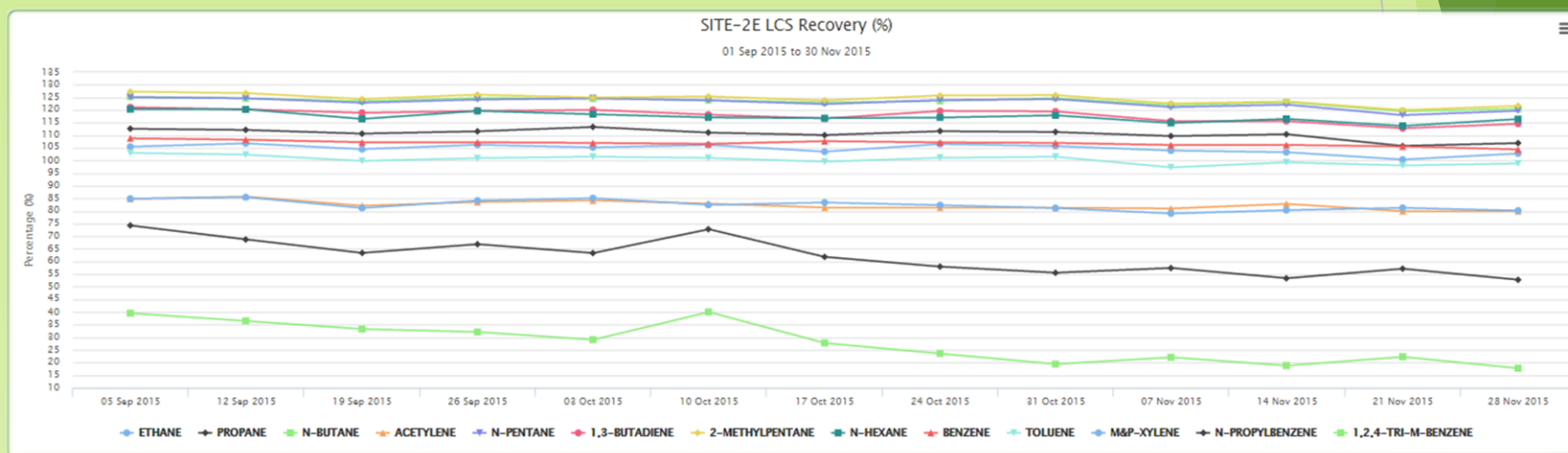


Recoveries based on carbon response for Propane or Benzene

AUTO GC Systems: Level I Data Review

Laboratory Control Sample (LCS)

Weekly Static Dilution Canister Sample



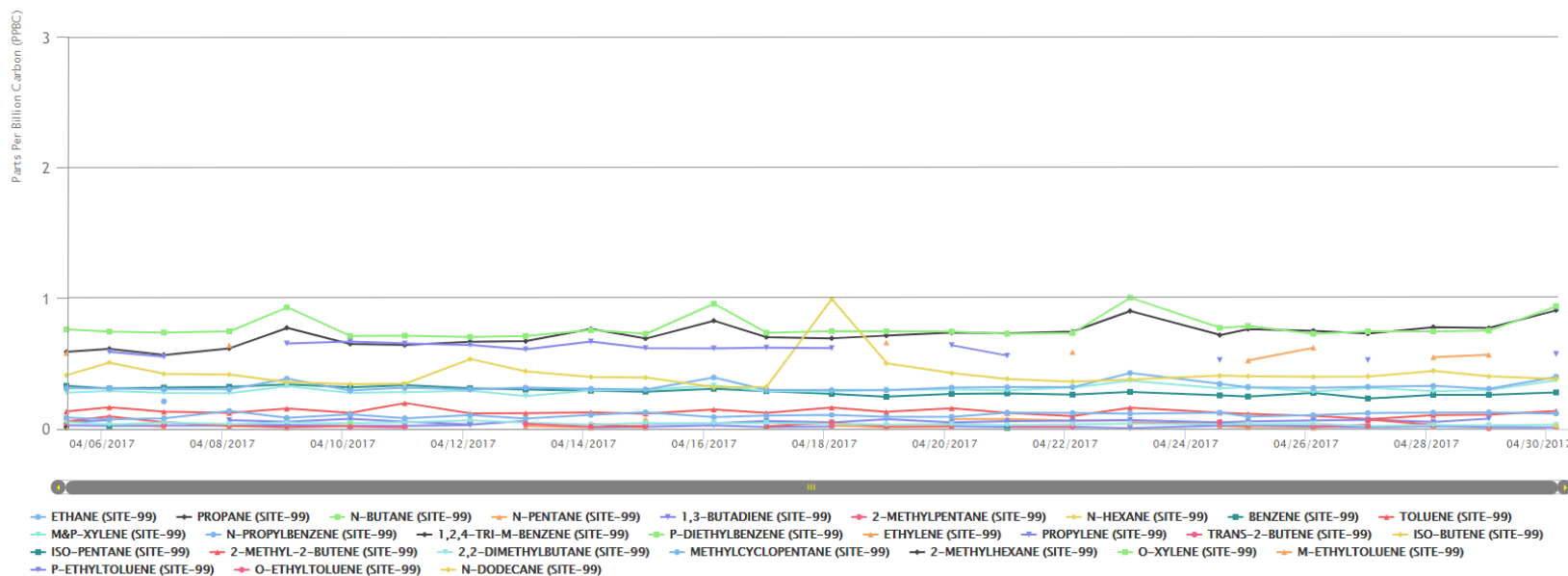
AutoGC Systems: Level I Data Review

Daily Blank Sample



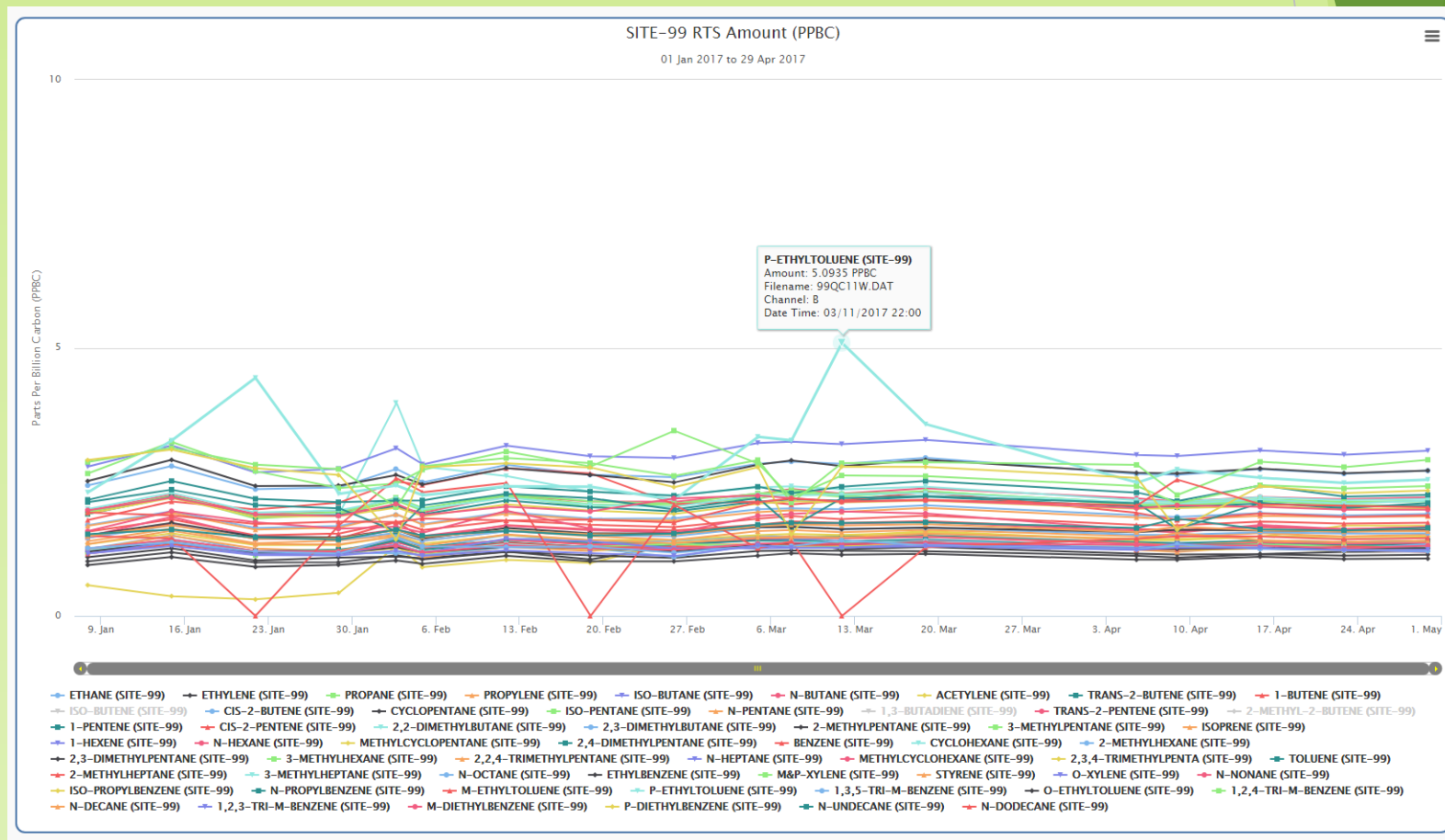
SITE-99 Blank Amount (PPBC)

01 Apr 2017 to 30 Apr 2017



AUTOGC Systems: Level I Data Review

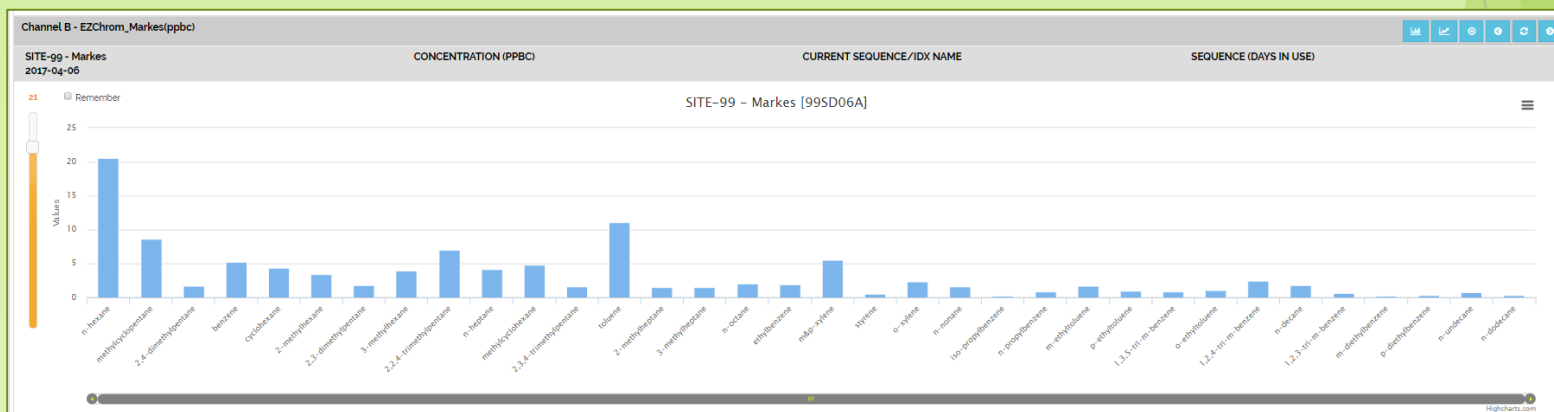
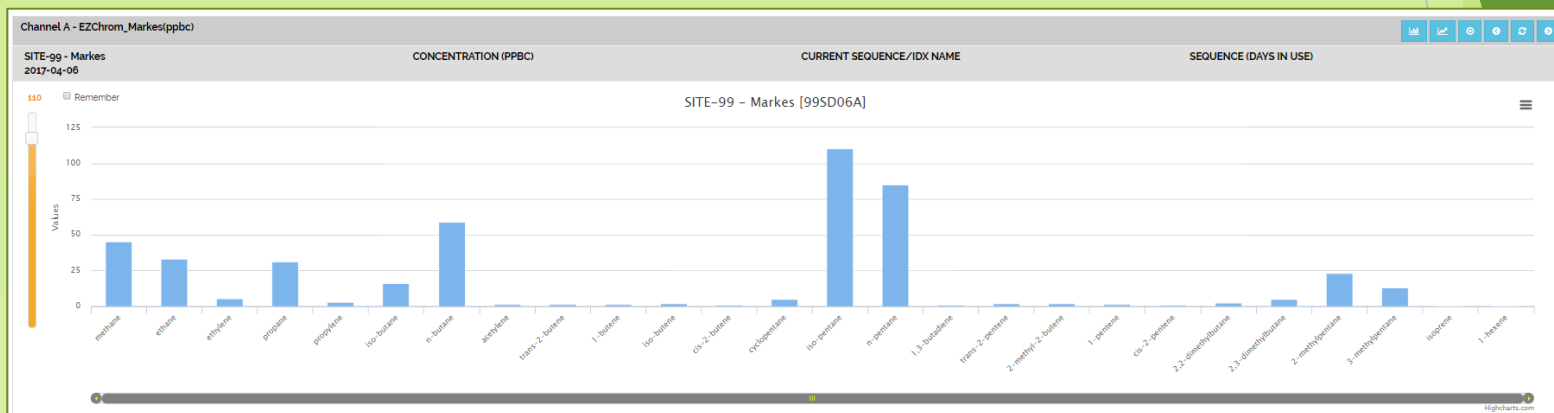
Retention Time Standard - Target Identification



AutoGC Systems: Level II Data Review

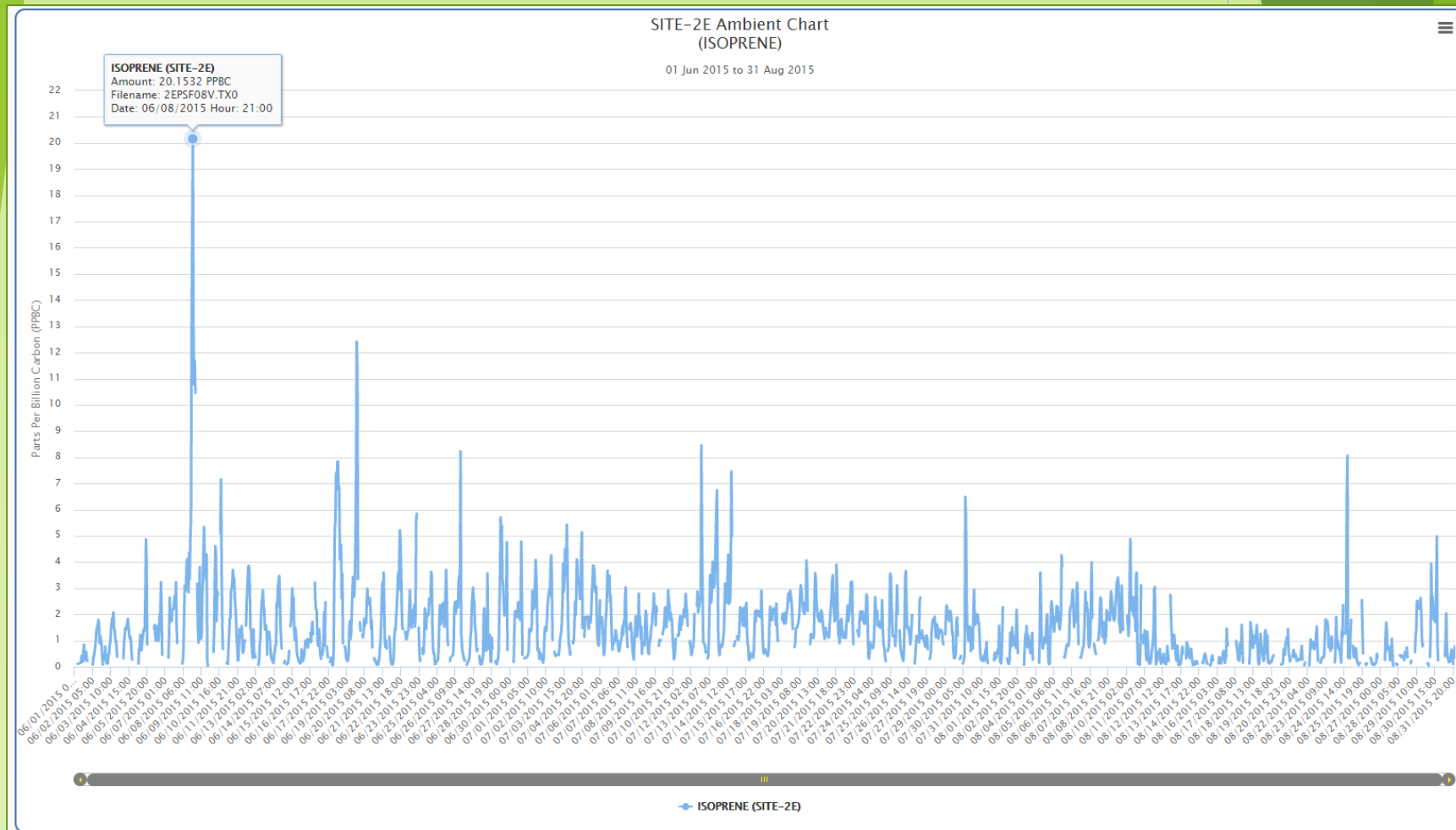


Abundant Species



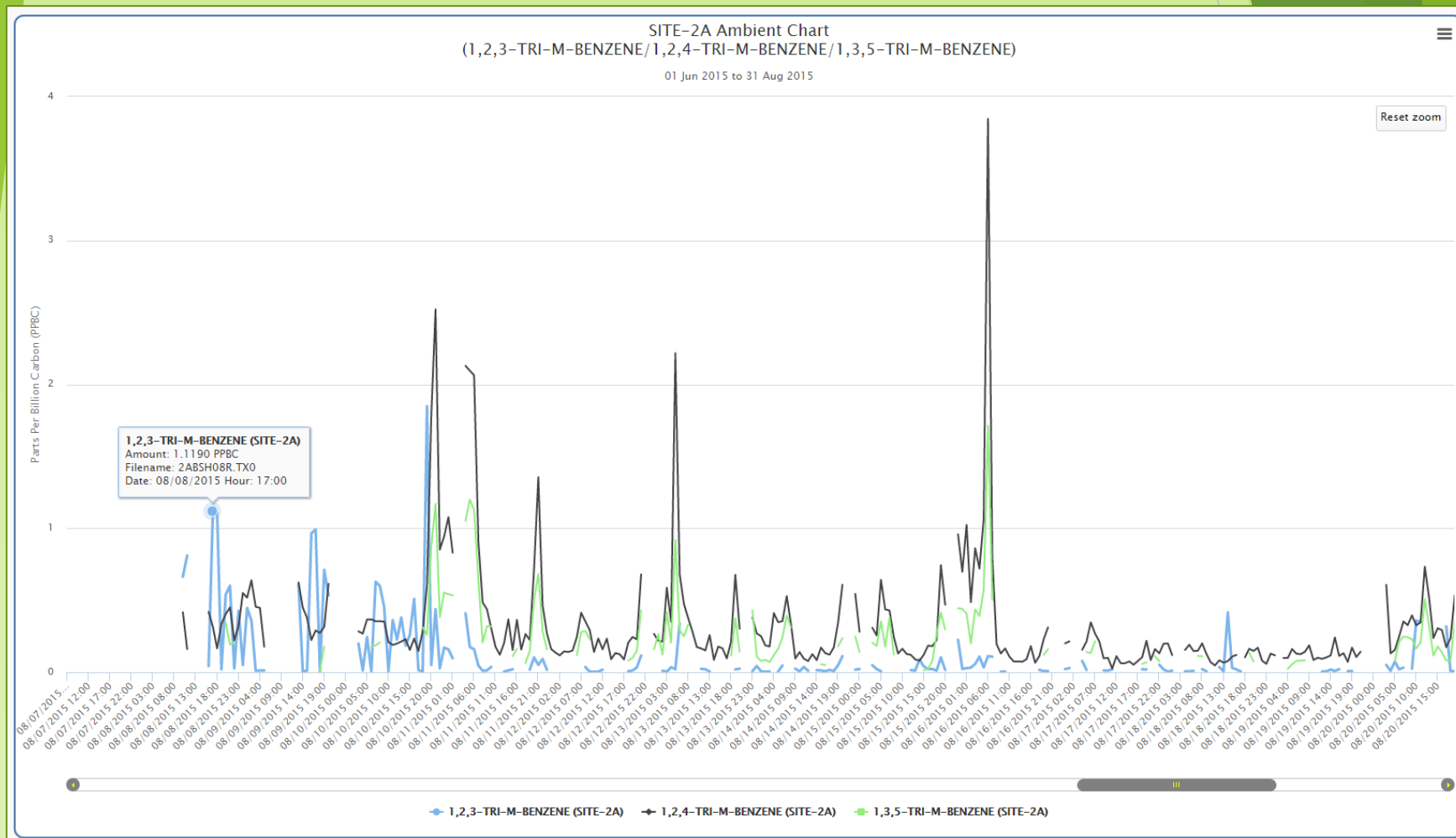
AUTOGC Systems: Level II Data Review

Ambient Data - Time Series - Diurnal Patterns



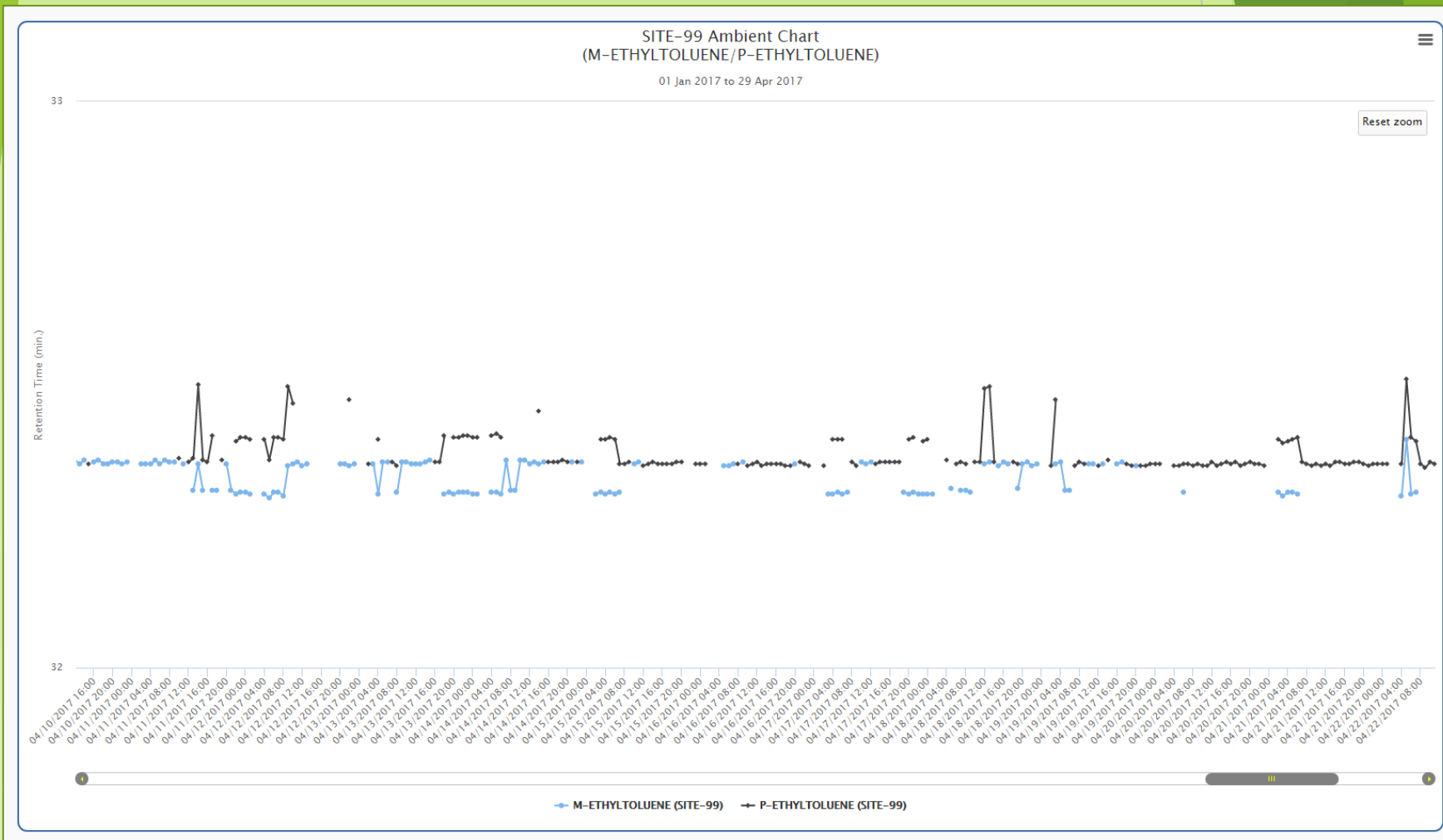
AUTOGC Systems: Level II Data Review

Ambient Data - Time Series - Common Relationships



AUTOGC Systems: Level II Data Review

Ambient Data - Time Series - Retention Time Plots



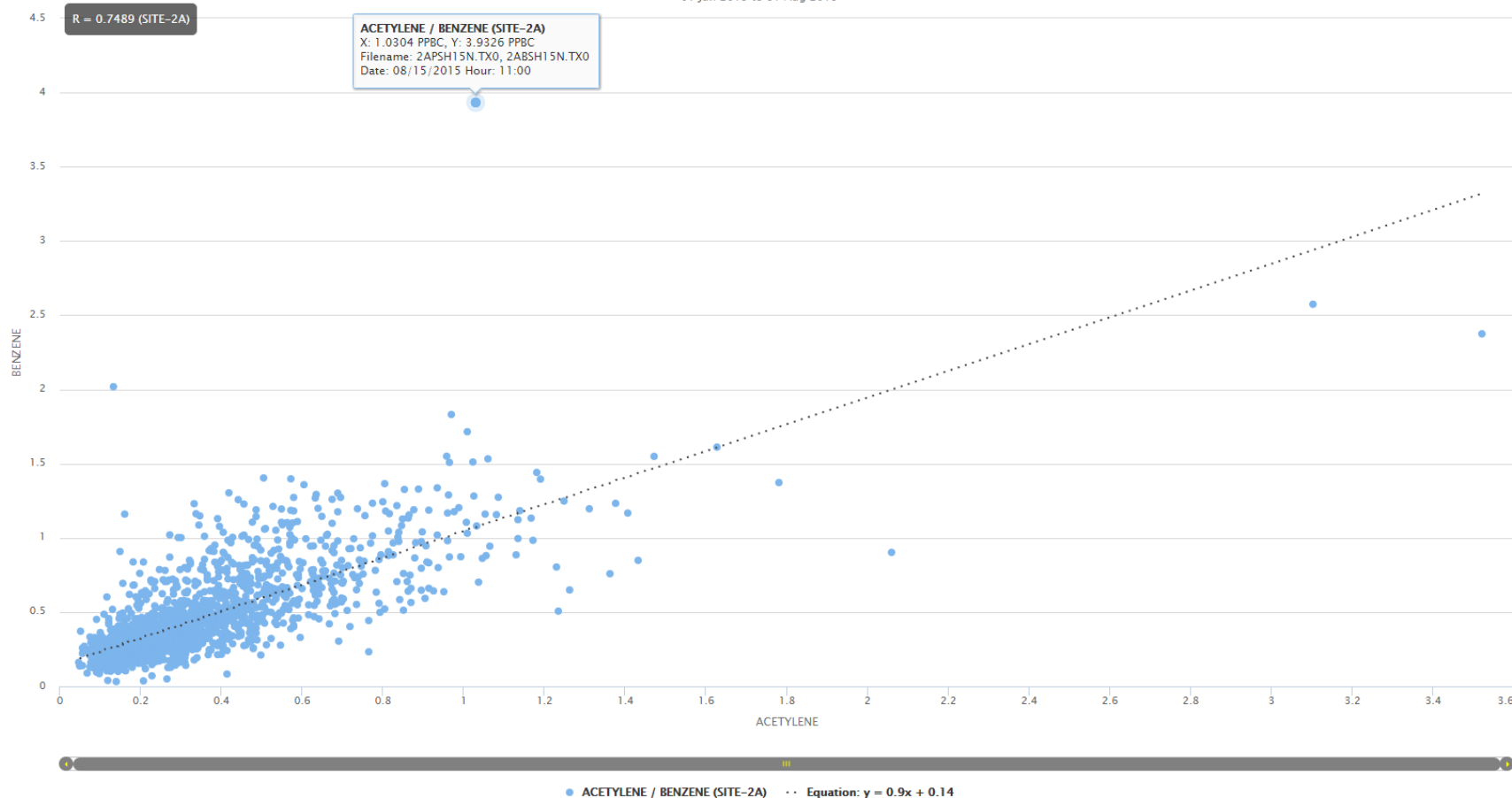
AUTOGC Systems: Level II Data Review

Ambient Data - Scatter Plots



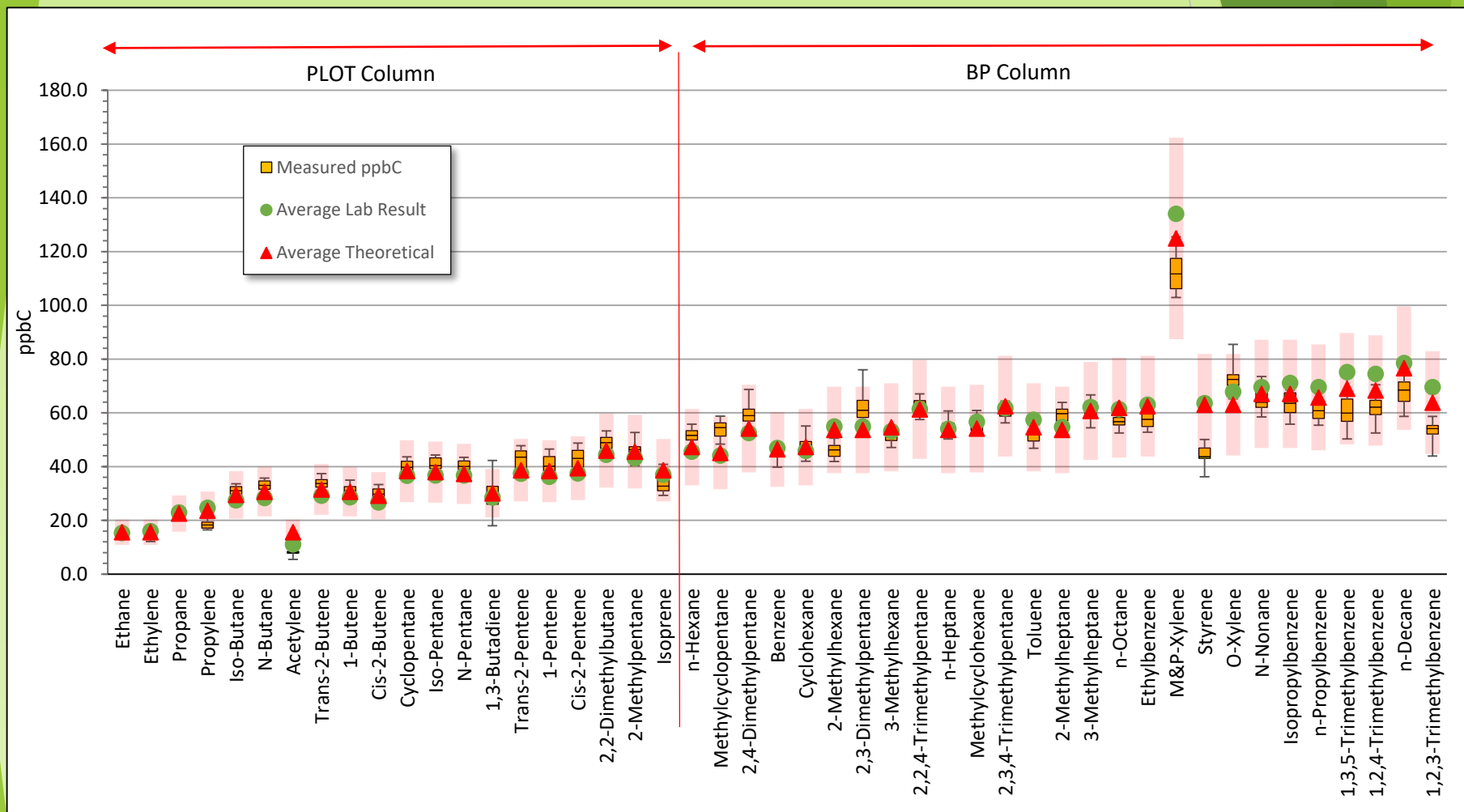
SITE-2A ACETYLENE / BENZENE Relationship

01 Jun 2015 to 31 Aug 2015



AUTOGE Systems: Level III Data Review

Performance Evaluation Audits



Requirements for Successful AutoGC

▶ Chromatographic Data System

- ▶ Capable of identification and quantitation of complex samples
- ▶ Robust and simple calibration strategy
- ▶ Output format for easy review of data
- ▶ Event control for automation of quality control checks

▶ Standard Operating Procedures

- ▶ Daily operations for consistent data collection
- ▶ Validation to handle deviations consistently

▶ Data Quality Objectives

- ▶ Well defined control limits
- ▶ System for identifying and correcting failures



FIFTY SIX
NON-METHANE
 HYDROCARBONS
 TWENTY FOUR
 HOURS A DAY
SEVEN
 DAYS A WEEK

“Acknowledgements

“Without data you are just another person with an opinion.” ---W. Edwards Deming

Nicola Watson, Markes International

Kelly Beard, Agilent Technologies



Lee Marotta, PerkinElmer

Corey Whipp, PerkinElmer



Texas Commission on Environmental Quality

Cory Chism

Cindy Maresh

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